

CLAIMS

1. A negative resistance field-effect element comprising: an InAlAs or AlGaAs barrier layer (12) that, owing to being formed on an InP or GaAs substrate (11) having an asymmetrical V-groove whose surface on one side is a (100) plane and surface on the other side is a (011) plane, has a trench (TR), one of whose opposed lateral faces is a (111) A plane and the other of which is a (331) B plane; an InGaAs or GaAs quantum wire (13) grown on a trench bottom surface of the barrier layer as a high-mobility channel having a relatively narrow energy band gap; an InAlAs or AlGaAs spacer layer (21) grown on the quantum wire as a low-mobility channel having a relatively wide energy band gap; a source electrode (42) and a drain electrode (43) each in electrical continuity with the high-mobility channel (13) through a contact layer (30) and extending in a longitudinal direction of the quantum wire as spaced from each other; and a gate electrode (41) provided between the source electrode and the drain electrode to face the low-mobility channel through an insulating layer or a Schottky junction.
2. The negative resistance field-effect element according to claim 1, further comprising a delta-doped layer (22) that lowers conduction band energy and is provided locally within the low-mobility channel (20) and wherein the InAlAs or AlGaAs spacer layer constitutes a modulation-doped layer.
3. The negative resistance field-effect element according to claim 1, wherein the contact layer (30) is a laminated structure of an n-type InAlAs layer (31), an n-type InGaAs layer (32), an n-type InAlAs layer and an n-type InAs layer.